SCIENCE: CURRICULUM CONTENT AND PROGRESSION FRAMEWORK

‘All truths are easy to understand once they are discovered; the point is to discover them.’ – Galileo Galilei

Aims

The national curriculum for maths aims to ensure that all pupils:

- develop scientific knowledge and conceptual understanding through the specific disciplines of biology, chemistry and physics
- develop understanding of the nature, processes and methods of science through different types of science enquiries that help them to answer scientific questions about the world around them
- are equipped with the scientific knowledge required to understand the uses and implications of science, today and for the future.

At Kirk Fenton, scientific enquiry is at the heart of our science curriculum. Each lesson is rooted in one of the 5 types of enquiry: comparative and fair testing, observing over time, pattern seeking, identifying, classifying and grouping, research using secondary sources. We believe that engaging children early in science through stimulating, hands-on learning will create a love of the subject and pave the way for future study. We have created a science curriculum with strong literacy links through the use of related texts, including fiction, non-fiction and poetry. This gives context and meaning to the learning in an age-appropriate way. Each unit of work also has at least one focus scientist from the past to the present, chosen to represent the diversity of the scientific community.

All children at Kirk Fenton have the opportunity to reach the Star (KS1) and Superstar (KS2) levels of the CREST award; the British Science Association’s scheme for STEM project work.

FOUNDATION

Curriculum Content:

Understanding the world:

Children know about similarities and differences in relation to places, objects, materials and living things. They talk about the features of their own immediate environment and how environments might vary from one another. They make observations of animals and plants and explain why some things occur, and talk about changes.

YEAR 1
Curriculum Content:
• Plants • Animals, including humans • Everyday materials • Seasonal changes
YEAR 2
Curriculum Content:
• Living things and their habitats • Plants • Animals, including humans • Uses of everyday materials
YEAR 3
Curriculum Content:
• Plants • Animals, including humans • Rocks • Light • Forces and magnets
YEAR 4
Curriculum Content:
• Living things and their habitats • Animals, including humans • States of matter • Sound • Electricity
YEAR 5
Curriculum Content:
• Living things and their habitats • Animals, including humans

- Properties and changes of materials
- Earth and space
- Forces

YEAR 6

Curriculum Content:

- Living things and their habitats
- Animals, including humans
- Evolution and inheritance
- Light
- Electricity

Each unit of work has a plan overview found below:

Plants - Year 1

National Curriculum Objectives

- Identify and name a variety of common wild and garden plants, including deciduous and evergreen trees.
- Identify and describe the basic structure of a variety of common flowering plants, including trees.

Sticky Knowledge

- Plants grow from seeds/bulbs.
- Plants need light and water to grow and survive.
- We can eat lots of plants.
- Garden plants are plants people choose to grow in their gardens.
- Weeds are wild plants that grow in places people don't want them.
- A wild plant grows where the seed lands. It doesn't need to be planted or cared for.

Key Scientists

Beatrix Potter
(Botanist & Natural Scientist)

John Ray
(Naturalist)

Vocabulary

blossom, branch, bud, bulb, deciduous, evergreen, flower, flowering, fruit, garden, leaf, leaves, petals, roots, seed, stem, trunk, vegetables, wild

Prior Learning

In EYFS Children should:

- Make observations of plants.
- Know some names of plants, trees and flowers and begin to describe them.
- Show some care for the world around them.

Future Learning

In Year 2 Children will:

- Observe and describe how seeds and bulbs grow into mature plants.
- Find out and describe how plants need water, light and warmth to grow and stay healthy.

Key Questions

- How do plants grow?
- What do plants need to grow?
- Do all plants need water?
- Are all plants green?
- Why do seeds look different?
- Can plants grow as big in the shade?
- What is the biggest/smallest/smelliest tree/flower/plant on the planet?

Which type of compost grows the tallest sunflower?

Which variety of potato grows best in our outdoor area?

How can we sort the leaves that we collected on our walk?

How many plants can we identify in our school grounds?

How does a daffodil bulb change over the year?

How does my sunflower change each week?

Do trees with bigger leaves lose their leaves first in autumn?

Is there a pattern in where we find moss growing in the school grounds?

What are the most common British plants and where can we find them?

How did Beatrix Potter help our understanding of mushrooms and toadstools?

BIG Question
(assessment opportunity)

How many types of plants are there?

5 types of enquiry symbols from: https://seerih-innovations.org/enquiringscience4all/

Animals, including humans - Year 1

National Curriculum Objectives

- Identify and name a variety of common animals including fish, amphibians, reptiles, birds and mammals.
- Identify and name a variety of common animals that are carnivores, herbivores and omnivores.
- Describe and compare the structure of a variety of common animals (fish, amphibians, reptiles, birds and mammals, including pets)
- Identify, name, draw and label the basic parts of the human body and say which part of the body is associated with each sense.

Sticky Knowledge

- There are many different animals with different characteristics.
- Animals have senses to help individuals survive; when animals sense things they are able to respond.
- Animals need food to survive but different animals have different diets.
- Animals need a variety of food to help them grow, repair their bodies, be active and stay healthy.

Vocabulary

arm, ears, elbow, eyes, face, fingers, foot, hair, hand, head, hearing, human body, knee, leg, mouth, neck, nose, sense, shoulder, sight, smell, sound, taste, teeth, texture, thumb, toes, touch, amphibians, animals, birds, carnivores, fish, habitat, herbivore, mammals, omnivore, pets, reptiles

Key Scientists

Jane Goodall
(Primatologist)

Joan Beauchamp Procter
(Zoologist)

Prior Learning

In Early Years children should:

- Be able to identify different parts of their body.
- Have some understanding of healthy food and the need for variety in their diets.
- Be able to show care and concern for living things.
- Know the effects exercise has on their bodies.
- Have some understanding of growth and change.
- Can talk about things they have observed including animals.

Future Learning

In Year 2 children will:

- Know that animals, including humans, have offspring which grow into adults.
- Know the basic stages in a life cycle for animals, including humans.
- Find out and describe the basic needs of animals, including humans, for survival (water, food and air).
- Describe the importance for humans of exercise, eating the right amounts of different types of food, and hygiene.

Key Questions

- What do animals eat?
- Do all animals eat the same food?
- Which of our senses is the most accurate at identifying food?
- Do all animals hunt?
- Why are animals different colours and patterns?

Is our sense of smell better when we can't see?

How can we organise all the zoo animals?

What are the names for all the parts of our bodies?

How does my height change over the year?

How many animals can be found under a rock at different times of the year?

Do you get better at smelling as you get older?

Do bigger animals have bigger poo?

Do all animals have the same senses as humans?

How do we look after animals?

BIG Question
(assessment opportunity)

What are animals like?

5 types of enquiry symbols from: https://seerih-innovations.org/enquiringscience4all/

Everyday Materials - Year 1

National Curriculum Objectives

- Distinguish between an object and the material from which it is made.
- Identify and name a variety of everyday materials, including wood, metal, plastic, glass, water and rock.
- Describe the simple physical properties of a variety of everyday materials.
- Compare and group together a variety of everyday materials on the basis of their simple properties.

Sticky Knowledge

- There are many different materials that have different describable and measurable properties.
- Materials that have similar properties are grouped into metals, rocks, fabrics, wood, plastic, ceramics and glass.
- The properties of a material determine whether they are suitable for a purpose.

Vocabulary

absorbent, bendy, dull, glass, hard, material, metal, object, opaque, plastic, properties, rock, rough, shiny, smooth, soft, stiff, stretchy, transparent, water, waterproof, wood

Key Scientists

Charles Mackintosh *(Chemist & Inventor)*

Ole Kirk Christiansen *(Inventor)*

Prior Learning

In Early Years children should:

- Be able to ask questions about the place they live.
- Talk about why things happen and how things work.
- Discuss the things they have observed such as natural and found objects.
- Manipulate materials to achieve a planned effect.

Future Learning

In Year 2 Children will:

- Identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses.
- Find out how shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching.

Key Questions

It is recommended that materials be taught two times in Y1. Give a theme for each topic e.g. buildings, exploration, toys, the seaside. Plan to investigate a couple of classes of materials and properties in each topic so children get a depth of experience each topic.

- When is a wooden spoon more suitable than a plastic spoon?
- Are all metals the same?
- Is glass only used for windows?
- Is all glass transparent?
- Which materials can be recycled?

Which materials are the most flexible?

Which materials are the most absorbent?

We need to choose a material to make an umbrella. Which materials are waterproof?

What happens to materials over time if we bury them in the ground?

What happens to ice over time?

Is there a pattern in the types of materials that are used to make objects in a school?

How is glass made?

What happens to our recycling?

BIG Question
(assessment opportunity)

What are the things I have used in my model made from? Why are they the best choice for the job?

5 types of enquiry symbols from: https://seerih-innovations.org/enquiringscience4all/

Seasonal Changes - Year 1

National Curriculum Objectives	Sticky Knowledge	Key Scientists
• Observe changes across the four seasons. • Observe and describe weather associated with the seasons and how day length varies.	• Weather can change. • The weather includes the temperature outside, wind direction and strength, as well as rain, cloud, snow and sun. • Daylight is when it is light outside. The amount of daylight changes with the seasons. • There are four seasons: spring, summer, autumn, winter	George James Symons *(Meteorologist)* Anders Celsius *(Astronomer, Physicist & Mathematician)*
	Vocabulary	
	autumn, changes, day length, overcast, rain, seasons, snow, spring, summer, Sun, sunny, temperature, weather, wind, winter	

Prior Learning	Future Learning	Key Questions
In Early Years children should: • Developing an understanding of change. • Observe and explain why certain things may occur (e.g leaves falling off trees, weather changes). • Look closely at similarities, differences, patterns and change. • Make comments and questions about the place they live or the wider natural world.	**In Year 2 Children will:** • Recognise that they need light in order to see things and that dark is the absence of light. • Notice that light is reflected from surfaces. • Recognise that light from the sun can be dangerous and that there are ways to protect their eyes. • Recognise that shadows are formed when the light from a light source is blocked by a solid object. • Find patterns in the way that the sizes of shadows change.	• How long does it take for the ground to dry after it has been raining? • Do countries with higher temperatures have less rain? • How does rainfall and temperature change over time in our school grounds? • What do you notice about different leaves? • Why do you think leaves turn brown in autumn? What colours can we find outside? Does this change across the seasons? • What effect does rain have on the environment? • What would happen if there was too much or not enough rain?

 In which month does it rain the most?	 How would you identify and record the weather over a week or month?	 How does a tree change over a year?	 Does the wind always blow the same way?	 Which countries in the world have different types of weather to us?	**BIG Question** (assessment opportunity) What is it like in spring, summer, autumn and winter?

5 types of enquiry symbols from: https://seerih-innovations.org/enquiringscience4all/

Living things and their habitats - Year 2

National Curriculum Objectives

- Explore and compare the difference between things that are living, dead and things that have never been alive.
- Identify that most living things live in habitats to which they are suited and describe how different habitats provide for the basic needs of different kinds of animals and plants, and how they depend on each other.
- Identify and name a variety of plants and animals in their habitats, including micro-habitats.
- Describe how animals obtain their food from plants and other animals, using the idea of a simple food chain, and identify and name the different sources of food.

Sticky Knowledge

- Some things are living, some were once living but now dead and some things never lived.
- There is variation between living things.
- Different animals and plants live in different places. Living things are adapted to survive in different habitats.
- Environmental change can affect plants and animals that live there.

Vocabulary

alive, animals, basic needs, characteristics, conditions, dead, depend on, environment, food, food chain, habitat, healthy, living, micro-habitat, plants, provide, shelter, sources, suited

Key Scientists

Sylvia Earle
(Marine Biologist & Explorer)

Ernest Shackleton
(Arctic Explorer)

Prior Learning

In EYFS children should:

- Make comments and questions about the place they live and the wider natural world.
- Show care and concern for living things and the environment.
- Talk about things they have observed such as plants and animals.
- Notice features of objects in their environment.

Future Learning

In Year 4 children will:

- Recognise that living things can be grouped in a variety of ways.
- Explore and use classification keys to help group, identify and name a variety of living things in their local and wider environment.
- Recognise that environments can change and that this can sometimes pose danger to living things.

Key Questions

- How do animals eat?
- Do all animals eat the same thing?
- Which animals hunt, and which animals are hunted?
- What animals live in our school environment?
- How are animals and plants 'adapted' to live in their habitats?
- Why do animals and plants like to live in different places?
- How do seasons affect our animals and plants?
- Which animals hibernate and why?
- Why do snails hibernate, but slugs don't?
- How do habitats change over our school year?

Which pets are the easiest to look after?

Is there the same level of light in the evergreen wood compared with the deciduous wood?

How would you group these plants and animals based on what habitat you would find them in?

How does the school pond change over the period of a year?

What conditions do woodlice prefer to live in?

Which habitat do worms prefer – where can we find the most worms?

How are the animals in India different to the ones that we find in Britain?

How does the habitat of the Arctic compare with the habitat of the rainforest?

BIG Question
(assessment opportunity)

Why do different animals live in different places?

5 types of enquiry symbols from: https://seerih-innovations.org/enquiringscience4all/

Plants - Year 2

Kirk Fenton CE PRIMARY SCHOOL

National Curriculum Objectives	Sticky Knowledge	Key Scientists
• Observe and describe how seeds and bulbs grow into mature plants. • Find out and describe how plants need water, light and warmth to grow and stay healthy.	• Plants grow from seeds/bulbs. • Plants need light, water and warmth to grow and survive. • Flowers make seeds to make more plants (reproduce). • Plants are important. • We need plants to survive (to clean air, to eat). • We can eat different parts of the plants (leaves, stems, roots, seeds, fruit). **Vocabulary** bulbs, environment, germination, grow, healthy, light, mature plants, reproduction, seeds, store of food, survival, temperature, water	Jane Colden *(Botanist)* Agnes Arber *(Botanist)*

Prior Learning	Future Learning	Key Questions
In Year 1 Children should: • Identify and name a variety of common wild and garden plants, including deciduous and evergreen trees. • Identify and describe the basic structure of a variety of common flowering plants.	**In Year 3 Children will:** • Identify and describe the functions of different parts of the flowering plant: roots, stem/trunk/leaves and flowers. • Explore the part flowers play in a flowering plants life cycle, including: pollination, seed formation and seed dispersal. • Explain the requirements of plants for life and growth (air, light, water, nutrients from soil, room to grow) and how they vary between plants. • Investigate the way in which water is transported between plants.	• Do cress produce seeds, how could we find out? • Do all plants produce flowers and seeds? • What is different between freshly cut and planted flowers? • Do plants flower all year round? • What are flowers for? • What happens to a plant after it has produced seeds? • How does light affect plant growth? • How does warmth affect plant growth? • What does the life cycle of a blackberry look like?

 Do cress seeds grow quicker inside or outside?	 Can we identify and group different seeds and bulbs?	 What happens to my bean after I have planted it?	 Do bigger seeds grow into bigger plants?	 How does a cactus survive in a desert with no water?	**BIG Question** (assessment opportunity) What should I do to grow a healthy plant?

5 types of enquiry symbols from: https://seerih-innovations.org/enquiringscience4all/

Animals, including humans - Year 2

National Curriculum Objectives

- Notice that animals, including humans, have offspring which grow into adults.
- Find out about and describe the basic needs of animals, including humans, for survival (water, food and air).
- Describe the importance for humans of exercise, eating the right amounts of different types of food, and hygiene.

Sticky Knowledge

- Different animals move in different ways to help them survive.
- Exercise and a good diet keeps animals' bodies in good condition and increases survival chances.
- Animals reproduce new animals when they reach maturity. Some animals give birth to live young and some animals lay eggs.
- Animals grow until maturity and then don't grow any larger. All animals eventually die.
- To stop illness and infection we need to maintain a healthy lifestyle and keep ourselves clean.

Vocabulary

adult, air, animals, baby, basic needs, child, exercise, food, growth, humans, hygiene, maturity, nutrition, offspring, reproduction, survival, teenager, toddler, water, egg/chick/chicken, spawn/tadpole/frog, egg/caterpillar/pupa/butterfly, lamb/sheep

Key Scientists

Maria Sibylla Merian (*Scientific Illustrator & Entomologist*)

Louis Pasteur *(Biologist & Chemist)*

Prior Learning

In Year 1 Children should:

- Identify and name a variety of common animals including fish, amphibians, reptiles, birds and mammals.
- Identify and name a variety of common animals that are carnivores, herbivores and omnivores.

Future Learning

In Year 3 Children will:

- Identify that animals, including humans, need the right types and amount of nutrition, and they cannot make their own food; they get their nutrition from what they eat.
- Know how nutrients, water and oxygen are transported within animals and humans.
- Know about the importance of a nutritious, balanced diet.
- Identify that humans and some other animals have skeletons and muscles for support, protection and movement.

Key Questions

- Do all animals grow and live the same way?
- Do bigger animals live longer?
- Why are we all different heights?
- How and why do we grow and change?
- What do we 'want' and what do we 'need'?
- Why do we need to eat different types of food?
- Do all babies look like their parents?

Do bananas make us run faster?

Which offspring belongs to which animal?

How does a tadpole/butterfly change over time?
How much food and drink do I have over a week?

Which age group of children wash their hands the most in a day?

What food do you need in a healthy diet and why?

BIG Question
(assessment opportunity)

Do living things change or stay the same?

5 types of enquiry symbols from: https://seerih-innovations.org/enquiringscience4all/

Uses of everyday materials - Year 2

National Curriculum Objectives

- Identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses.
- Find out how shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching.

Sticky Knowledge

- Materials can be changed by physical force (twisting, bending, squashing and stretching).
- Materials can be used for more than one thing e.g. metal: coins, cans, cars, table legs.
- Different materials can be used for the same thing e.g. a spoon made from wood, metal, plastic.
- Suitability means having the right properties for a particular purpose.

Vocabulary

bending, brick, cardboard, changed, glass, materials, metal, paper, plastic, properties, purpose, rock, shapes, squashing, stretching, suitability, suitable, twisting, unsuitable, uses, wood

Key Scientists

John Dunlop
(Inventor)

Robert Gair
(Inventor)

Prior Learning

In Y1 children should:

- Distinguish between an object and the material from which it is made.
- Identify and name a variety of everyday materials, including wood, metal, plastic, glass, water and rock,.
- Describe the simple physical properties of a variety of everyday materials.
- Compare and group together a variety of everyday materials on the basis of their simple properties.

Future Learning

In Year 3 children will:

- Compare and group together different kinds of rocks on the basis of their appearance and simple physical properties.
- Describe in simple terms how fossils are formed when things that have lived are trapped within rock.
- Recognise that soils are made from rocks and organic matter.

Key Questions

- Which rocks are the least crumbly?
- Which materials absorb the most water?
- Which material would be the strongest to use as to make a roof on a model?
- How long do plastics last for?
- What types of bricks can you see in our village?
- Which material makes the bounciest ball?
- What are aeroplane wheels made out of and why?

Are all objects made out of metal rigid?

Can you group different types of paper and cardboard?

How do different types of paper/card change over time when they are buried in the ground?

How does water affect the strength of different types of paper or cardboard?

How is corrugated cardboard made?

BIG Question
(assessment opportunity)

What is the best material for each part of my model?

5 types of enquiry symbols from: https://seerih-innovations.org/enquiringscience4all/

Plants - Year 3

National Curriculum Objectives

- Identify and describe the functions of different parts of the flowering plant: roots, stem/trunk/leaves and flowers.
- Explore the requirements of plants for life and growth (air, light, water, nutrients from soil, and room to grow) and how they vary from plant to plant.
- Investigate the way in which water is transported within plants.
- Explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal.

Sticky Knowledge

- Plants are producers, they make their own food.
- Their leaves absorb sunlight and carbon dioxide.
- Plants have roots, which provide support and draw water from the soil.
- Flowering plants have specific adaptations which help it to carry out pollination, fertilisation and seed production.
- Seed dispersal improves a plant's chances of successful reproduction.
- Seeds/bulbs require the right conditions to germinate and grow.
- Seeds contain enough food for the plant's initial growth.

Vocabulary

air, anchor, fertiliser, flowering plants, flowers, functions, growth, leaves, life, life cycle, light, nutrients, nutrition, plants, pollination, reproduction, requirements, room to grow

Key Scientists

Stephen Hales *(Botanist)*

Anna Atkins *(Botanist & Photographer)*

Prior Learning

In Year 2 Children should:

- Observe and describe how seeds and bulbs grow into mature plants.
- Find out and describe how plants need water, light and warmth to grow and stay healthy.

Future Learning

In UKS2 Children will:

- Describe the life process of reproduction in some plants and animals.
- Describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including microorganisms, plants and animals.
- Give reasons for classifying plants and animals based on specific characteristics.
- Identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution.

Key Questions

- How do plants reproduce?
- How do insects know which flowers to pollinate?
- Why do flowers smell?
- What do seeds do?
- Can a plant live without its leaves?
- What conditions are perfect for a seed to grow?
- Where do weeds come from?
- How does the space between seeds affect how well they grow?
- Do plants take in water through their roots?
- How does water move through the plant?

How does the length of the carnation stem affect how long it takes for the food colouring to dye the petals?

Does the amount of fertiliser affect how a plant grows?

How many different ways can you group our seed collection?

Can you identify all the parts of a flowering plant?

What happens to celery when it is left in a glass of coloured water?

How do flowers in a vase change over time?

What colour flowers do pollinating insects prefer?

What are all the different ways that seeds disperse?

How is a cactus the same/different to a birch tree?

BIG Question

(assessment opportunity)

Why do plants have flowers?

5 types of enquiry symbols from: https://seerih-innovations.org/enquiringscience4all/

Animals, including humans - Year 3

National Curriculum Objectives

- Identify that animals, including humans, need the right types and amount of nutrition, and that they cannot make their own food; they get nutrition from what they eat.
- Identify that humans and some other animals have skeletons and muscles for support, protection and movement.

Sticky Knowledge

- Different animals are adapted to eat different foods.
- To stay healthy, humans need to exercise, eat a healthy diet and be hygienic.
- Many animals have skeletons to protect vital organs inside the body, allow movement and support the body and stop it from falling on the floor.
- Muscles are connected to bones and move them when they contract.
- Movable joints connect bones.

Vocabulary

amount, animals, body parts, carbohydrates, diet, eat, endoskeleton, exoskeleton, fats, fibre, food, food groups, functions, healthy, humans, invertebrates, joints, meals, minerals, movement, muscles, nutrition, protection, protein, skeletons, support, types, vertebrates, vitamins

Key Scientists

Wilhelm Rontgen *(Mechanical Engineer & Physicist)*

Ibn Sina "Avicenna" *(Physician)*

Prior Learning

In Year 2 children should:

- Know that animals, including humans, have offspring which grow into adults.
- Know the basic stages in a life cycle for animals, including humans.
- Find out and describe the basic needs of animals, including humans, for survival (water, food and air).
- Describe the importance for humans of exercise, eating the right amounts of different types of food, and hygiene.

Future Learning

In Year 4 children will:

- Describe the simple functions of the basic parts of the digestive system in humans.
- Identify the different types of teeth in humans and their simple functions.
- Construct and interpret a variety of food chains, identifying producers, predators and prey.

Key Questions

- Why do we need a skeleton?
- What types of skeletons are there?
- Are all skeletons the same?
- Can something survive without a skeleton?
- What happens if we break a bone?
- How do we move?
- Are bones that are bigger, stronger?
- Why do we need joints?
- Why do muscles get tired?
- Can we 'break' muscles?

How does the angle that your elbow/knee is bent affect the circumference of your upper arm/thigh?

How does the skull circumference of a girl compare with that of a boy?

How do the skeletons of different animals compare?

Can bones be grouped? How?

How does our skeleton change over time (from birth to death)?

Do all animals have a [name of bone] e.g. tibia?

Why do different types of vitamins keep us healthy and which foods can we find them in?

BIG Question
(assessment opportunity)

Why do animals have skeletons?

What is a healthy diet and why is it important?

5 types of enquiry symbols from: https://seerih-innovations.org/enquiringscience4all/

Rocks - Year 3

National Curriculum Objectives

- Compare and group together different kinds of rocks on the basis of their appearance and simple physical properties.
- Describe in simple terms how fossils are formed when things that have lived are trapped within rock.
- Recognise that soils are made from rocks and organic matter.

Sticky Knowledge

- Some rocks are natural and some are human-made. There are 3 types of naturally occurring rock.
- Soil is the uppermost layer of the earth and is made up of different things.
- Different plants grow in different soils.
- Fossils tell us what has happened before (they give us evidence) and show that living things have changed over time.
- Fossils are most commonly found in sedimentary rock.
- Paleontologists use Fossils to find out about the past.

Vocabulary

appearance, buildings, crystals, formed, fossils, grains, gravestones, organic matter, physical properties, rocks, sedimentary rock, soils, trapped

Key Scientists

Mary Anning
(Paleontologist)

Florence Bascom
(Geologist)

Prior Learning

In Year 2 Children should:

- Identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses.
- Find out how shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching.

NB: Children may have a basic understanding of soil, fossils and rocks from EYFS.

Future Learning

In Year 4 children will:

- Compare and group materials together, according to whether they are solids, liquids or gases.
- Observe that some materials change state when heated or cooled, and measure and research the temperature at which this happens in degrees Celsius.
- Identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature.

In Year 6 children will:

- Recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago.

Key Questions

- How are the soils different?
- Which do you think has the best drainage?
- Which is more likely to lead to flooding?
- How many soil types have we found?
- How might the soil be different in different countries?
- What rock is best for a kitchen chopping board?
- What types of rocks are there?
- How do rocks change?
- What would grow best in your soil?
- Why do you think worms are important to the creation of soil?
- How can we use composting to make our own soil?
- How are fossils created?
- Why do fossils help us find out about historical events?

How does adding different amounts of sand to soil affect how quickly water drains through it?
Which soil absorbs the most water?

Can you use the identification key to find out the name of each of the rocks in your collection?

How does tumbling change a rock over time?

What happens when water keeps dripping on a sandcastle?

Is there a pattern in where we find volcanoes on planet Earth?

Who was Mary Anning and what did she discover?

BIG Question
(assessment opportunity)

What are rocks and soils like?

5 types of enquiry symbols from: https://seerih-innovations.org/enquiringscience4all/

Light - Year 3

National Curriculum Objectives

- Recognise that they need light in order to see things and that dark is the absence of light.
- Notice that light is reflected from surfaces.
- Recognise that light from the sun can be dangerous and that there are ways to protect their eyes.
- Recognise that shadows are formed when the light from a light source is blocked by an opaque object.
- Find patterns in the way that the size of shadows change.

Sticky Knowledge

- There must be light for us to see; without light it is dark.
- We need light to see things, even shiny things.
- Transparent materials let light through them and opaque materials don't let light through.
- Beams of light bounce off some materials (reflection).
- Smooth, shiny materials reflect light beams better than bumpy, non-shiny materials.
- Light comes from a source.
- Reflective materials can be very useful e.g. cat's eyes, hi-vis jacket.

Vocabulary

absence, beam, blocked, danger, dark, distance, glare, light, light source, mirror, opaque, patterns, protect, ray, reflect, shadows, Sun, surfaces

Key Scientists

Ibn al-Haytham "Alhazen" *(Inventor)*

Lewis Latimer *(Inventor)*

Prior Learning

In Year 1 children should:

- Observe changes across the four seasons.
- Observe and describe weather associated with the seasons and how day length varies.

Future Learning

In Year 6 children will:

- Recognise that light appears to travel in straight lines.
- Use the idea that light travels in straight lines to explain that objects are seen because they give out or reflect light into the eye.
- Explain that we see things because light travels from light sources to our eyes or from light sources to objects and then to our eyes.
- Use the idea that light travels in straight lines to explain why shadows have the same shape as the objects that cast them.

Key Questions

- A coin is lost, what would be the best way to find it? (Turn the lights out and see it shine? Use a torch to see it reflect?)
- What colour would be the best to make a safety jacket?
- How does the colour of a material affect how reflective it is?
- How does the thickness of a material affect how much light can pass through it?
- How many pieces of tracing paper are as translucent as a single piece of white paper?
- How does the shape of a mirror affect how the light reflects?
- How can we change the darkness, size and shape of a shadow?

How does the distance between the shadow puppet and the screen affect the size of the shadow?
Which pair of sunglasses will be best at protecting our eyes?

How would you organise these light sources into natural and artificial sources?

Is the Sun the same brightness all day?

How does my shadow change over a day/month/year?

Do all dark fabrics block out a light source?

How does the Sun make light?

BIG Question
(assessment opportunity)

What is a shadow?

5 types of enquiry symbols from: https://seerih-innovations.org/enquiringscience4all/

Forces and Magnets - Year 3

National Curriculum Objectives

- Compare how things move on different surfaces.
- Notice that some forces need contact between two objects, but magnetic forces can act at a distance.
- Observe how magnets attract or repel each other and attract some materials and not others.
- Compare and group together a variety of everyday materials on the basis of whether they are attracted to a magnet, and identify some magnetic materials.
- Describe magnets as having two poles.
- Predict whether two magnets will attract or repel each other, depending on which poles are facing.

Sticky Knowledge

- Forces can be pushes or pulls.
- Friction is a force that acts between two surfaces or objects that are moving (or trying to move) across each other.
- Magnets exert attractive and repulsive forces on each other.
- Magnets exert non-contact forces, which work through some materials.
- Magnets exert attractive forces on some materials which are affected by magnet strength, object mass, distance from object and object material.

Vocabulary

attract, compass, contact, distance, forces, magnetic, materials, move, objects, poles, properties, pull, push, repel, strength, surface, uses

Key Scientists

John McAdam
(Civil Engineer & Road Builder)

Isaac Newton
(Physicist)

Prior Learning

In EYFS/KS1 children should:

- Have an awareness of starting and stopping the movement of objects with pushes and pulls.
- Know that some objects float and some sink.
- Describe the physical properties of materials, including metal.

NB: This is a new topic of science study not introduced in KS1.

Future Learning

In Year 5 children will:

- Explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object and the impact of gravity on our lives.
- Identify the effects of air resistance, water resistance and friction, which act between moving surfaces.
- Recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect.
- Describe the movement of the Earth, and other planets, relative to the Sun in the solar system and the movement of the Moon relative to the Earth.
- Describe the Sun, Earth and Moon as approximately spherical bodies
- Describe the idea of the Earth's rotation to explain day and night and the apparent movement of the sun across the sky.

Key Questions

- What are magnetic materials? How can we find out?
- Can I make a magnetic material non-magnetic?
- How far away does a magnet have to be before it attracts a magnetic material?
- How far away can the magnetic attraction between two magnets be experienced?
- Is the repulsive force the same size?
- How is the magnetic attraction of repulsion force affected by putting materials between the magnets?
- Are bigger magnets stronger?

How does the mass of an object affect how much force is needed to make it move?

Which magnet is strongest?

Which materials are magnetic?

If we magnetise a pin, how long does it stay magnetised for?

Does the size and shape of a magnet affect how strong it is?
Are all shiny materials magnetic?

How have our ideas about forces changed over time?
How does a compass work?

BIG Question
(assessment opportunity)

How can we move magnets?

5 types of enquiry symbols from: https://seerih-innovations.org/enquiringscience4all/

Living things and their habitats - Year 4

National Curriculum Objectives

- Recognise that living things can be grouped in a variety of ways.
- Explore and use classification keys to help group, identify and name a variety of living things in their local and wider environment.
- Recognise that environments can change and that this can sometimes pose danger to living things.

Sticky Knowledge

- Living things can be divided into groups based upon their characteristics.
- Environmental change can positively or negatively affect a habitat; changes can be natural or caused by humans.
- Organisms are affected in different ways by environmental change.
- Conservationists work to help promote the protection of the environment.

Vocabulary

amphibians, birds, change, classification key, danger, deforestation, development, environment, fish, flowering, habitat, human impact, invertebrates, litter, living things, mammals, nature reserve, negative, non-flowering, population, positive, reptiles, vertebrate

Key Scientists

Jacques Cousteau *(Ocean Explorer & Conservationist)*

Rachel Carson *(Marine Biologist, Conservationist & Author)*

Prior Learning

In Year 2 children should:

- Explore and compare the difference between things that are living, dead and things that have never been alive.
- Identify that most living things live in habitats to which they are suited and describe how different habitats provide for the basic needs of different kinds of animals and plants, and how they depend on each other.
- Identify and name a variety of plants and animals in their habitats, including micro habitats.
- Describe how animals obtain their food from plants and other animals, using the idea of a simple food chain, and identify and name the different sources of food.

Future Learning

In Year 5 (Animals, including humans):

- Describe the differences in the life cycles of a mammal, an amphibian, an insect and a bird.
- Describe the life process of reproduction in some plants and animals.

In Year 6 (Living things and their habitats):

- Classify living things into broad groups according to observable characteristics and based on similarities and differences.
- Give reasons for classifying plants and animals based on specific characteristics.

Key Questions

- What food chains and webs are there in our local habitat?
- How does energy move through the food chain?
- How does removal of one species from an environment affect others? (keystone species)
- How does environmental change affect different organisms?
- What are the most important things we could do to improve our outside area? (pond, compost, wildflowers, litter picking)
- How does human activity affect our environment? (new house buildings, use of pesticides, deforestation)

Does the amount of light affect how many woodlice move around? How does the average temperature of the pond water change in each season?

Can we use the classification keys to identify all the animals that we caught pond dipping?

How does the variety of invertebrates on the school field change over the year?

Has the use of insecticides affected the bee population?

Why are people cutting down the rainforests and what effect does that have?

BIG Question
(assessment opportunity)

Are living things in danger?

5 types of enquiry symbols from: https://seerih-innovations.org/enquiringscience4all/

Animals including humans - Year 4

National Curriculum Objectives

- Describe the simple functions of the basic parts of the digestive system in humans.
- Identify the different types of teeth in humans and their simple functions.
- Construct and interpret a variety of food chains, identifying producers, predators and prey.

Sticky Knowledge

- The teeth of animals (including humans) are designed to eat different foods depending on the diet of the animal.
- Food is broken down by the teeth and further in the stomach and intestines where nutrients go into the blood; the blood takes nutrients around the body.
- Nutrients produced by plants move to primary consumers then to secondary consumers through food chains; this flow of energy is shown on a food chain.

Vocabulary

canine, carnivore, consumers, damages, digestive system, food chain, functions, herbivore, humans, incisor, large intestine, molar, mouth, oesophagus, predators, premolar, prey, producers, small intestine, stomach, teeth, tongue

Key Scientists

Marie M. Daly
(Biochemist)

Pierre Fauchard
(Physician)

Prior Learning

In Year 3 children should:

- Identify that animals, including humans, need the right types and amount of nutrition, and they cannot make their own food; they get their nutrition from what they eat.
- Know how nutrients, water and oxygen are transported within animals and humans.
- Know about the importance of a nutritious, balanced diet.
- Identify that humans and some other animals have skeletons and muscles for support, protection and movement.

Future Learning

In Year 5 children will:

- Describe the differences in the life cycles of a mammal, an amphibian, an insect and a bird.
- Describe the life process of reproduction in some plants and animals.
- Describe the changes as humans develop to old age.

Key Questions

- What different types of food are there?
- Why do we need a variety of different foods?
- Do all organisms eat the same things?
- Why do some people need different diets? (weightlifter vs marathon runner)
- Why are teeth important?
- What happens to our food?
- What is our digestive system?
- How does our food turn into faeces and urine?

In our class, are omnivores taller than vegetarians?

What are the names for all the organs involved in the digestive system?

Look at examples of teeth. Can we organise them into groups?

How does an egg shell change when it is left in cola, milk, water, vinegar? What does this tell us about oral hygiene?

Are foods that are high in energy always high in sugar?

How do dentists fix broken teeth?

BIG Question
(assessment opportunity)

What do our bodies do with the food we eat?

5 types of enquiry symbols from: https://seerih-innovations.org/enquiringscience4all/

States of Matter - Year 4

National Curriculum Objectives

- Compare and group materials together, according to whether they are solids, liquids or gases.
- Observe that some materials change state when they are heated or cooled, and measure or research the temperature at which this happens in degrees Celsius (°C).
- Identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature.

Sticky Knowledge

- Materials can be divided into solids, liquids and gases.
- Some materials can change from one state to another and back again.
- Heating causes solids to melt into liquids and liquids evaporate into gases.
- Cooling causes gases to condense into liquids and liquids to freeze into solids.
- The temperature at which given substances change state are always the same.
- Condensation and evaporation occur within the water cycle.

Vocabulary

change state, condensation, condense, cooled, degrees Celsius, escape, evaporation, everyday materials, gases, heated, liquids, melt, pool, shape, solids, substance, temperature, water cycle

Key Scientists

Daniel Gabriel Fahrenheit *(Physicist)*

Antoine Lavoisier *(Chemist)*

Prior Learning

In KS1 children should:

- Distinguish between an object and the material from which it is made.
- Identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock.
- Describe the simple physical properties of a variety of everyday materials.
- Compare and group together a variety of everyday materials on the basis of their simple physical properties.
- Identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses.
- Find out how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching.

Future Learning

In Year 5 children will:

- Compare and group together everyday materials on the basis of their properties, including hardness, solubility, transparency, conductivity (electrical and thermal), and response to magnets.
- Know that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution.
- Decide how mixtures might be separated, including through filtering, sieving and evaporating.
- Give reasons based on evidence from comparative and fair tests, for the particular uses of everyday materials, including wood, metals and plastic.
- Demonstrate that dissolving, mixing and changes of state are reversible changes.
- Explain that some changes result in the formation of new materials, and this kind of change is usually not reversible, including changes associated with burning and the action of acid on bicarbonate of soda.

Key Questions

- How does the amount of water added to flour affect its state?
- How does the amount of detergent added to water affect how slippy it is?
- Are all liquids the same?
- How does the material sprinkled on ice affect how quickly it melts?
- How does the type of chocolate affect its melting temperature?
- What is the melting temperature of ice and how does it compare with the freezing temperature of water?
- Is the melting temperature of wax the same as its freezing temperature?

How does the mass of a block of ice affect how long it takes to melt?
How does the surface area of water affect how long it takes to evaporate?

Can you group these materials and objects into solids, liquids, and gases?
How would you sort these objects/materials based on their temperature?

Which material is best for keeping our hot chocolate warm?
How does the level of water in a glass change when left on the windowsill?

Is there a pattern in how long it takes different sized ice lollies to melt?
How does the evaporation rate change as you add more salt to your water?

What are hurricanes, and why do they happen?

BIG Question
(assessment opportunity)

How can water change?

5 types of enquiry symbols from: https://seerih-innovations.org/enquiringscience4all/

Sound - Year 4

National Curriculum Objectives

- Identify how sounds are made, associating some of them with something vibrating.
- Recognise that vibrations from sounds travel through a medium to the ear.
- Find patterns between the pitch of a sound and features of the object that produced it.
- Find patterns between the volume of a sound and the strength of the vibrations that produced it.
- Recognise that sounds get fainter as the distance from the sound source increases.

Sticky Knowledge

- Sound is a type of energy created by vibrations; the louder the sound, the bigger the vibration.
- Sound travels from its source in all directions and we hear it when it travels to our ears.
- Sound travel can be blocked.
- Changing the shape, size and material of an object will change the sound it produces.
- Sound moves through all materials by making them vibrate; changing the way an object vibrates changes it's sound.
- Bigger vibrations produce louder sounds and smaller vibrations produce quieter sounds.
- Faster vibrations (higher frequencies) produce higher pitched sounds.

Vocabulary

distance, ear, fainter, features, high, instruments, insulation, loud, low, pitch, quiet, sound, sound source, strength, travel, vibrating, volume

Key Scientists

James West *(Inventor & Acoustician)*

Alexander Graham Bell *(Inventor & Engineer)*

Prior Learning

In KS1 children should:

- Have some understanding that objects make different sounds.
- Understand that they use their ears to hear sounds.
- Know about their different senses.

N.B. This is a new unit of learning not previously studied.

Future Learning

In KS3 children will:

- Know about frequencies of sound waves, measured in hertz (Hz); echoes, reflection and absorption of sound.
- Know that sound needs a medium to travel, the speed of sound in air, water and solids.
- Know that sound is produced by vibrations of objects and detected by the ear drum.
- Sound waves are longitudinal.
- The auditory range of humans and animals.

Key Questions

- How can you change the volume of a sound?
- How does the size of an ear trumpet affect the volume of sound detected?
- How does the type/thickness of material affect how well it blocks a sound?
- Which materials vibrate better and produce louder sounds? Can we identify any patterns?
- Which materials make the best string telephone components? (tin cans, paper cups, plastic cups, wire, cable, string, plastic or elastic)
- How does the length of the tube (when making a straw oboe) affect the pitch and volume?
- Can you predict the relative pitch of tuning forks from the patterns of ripples they make in the water?

How does the volume of a drum change as you move further away from it?
How does the length of a guitar string/tuning fork affect the pitch of the sound?

Which material is best to use for muffling sound in ear defenders?

When is our classroom the quietest?

Is there a link between how loud it is in school and the time of day? If there is a pattern, is it the same in every area of the school?

Do all animals have the same hearing range?

BIG Question
(assessment opportunity)

How can we make different sounds?

5 types of enquiry symbols from: https://seerih-innovations.org/enquiringscience4all/

Electricity - Year 4

National Curriculum Objectives

- Identify common appliances that run on electricity.
- Construct a simple series electrical circuit, identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzers.
- Identify whether or not a lamp will light in a simple series circuit, based on whether or not the lamp is part of a complete loop with a battery.
- Recognise that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit.
- Recognise some common conductors and insulators, and associate metals with being good conductors.

Sticky Knowledge

- A source of electricity (mains of battery) is needed for electrical devices to work.
- Electricity sources push electricity round a circuit.
- More batteries will push the electricity round the circuit faster.
- A complete circuit is needed for electricity to flow and devices to work.
- Some materials allow electricity to flow easily and these are called conductors.
- Materials that don't allow electricity to flow easily are called insulators.

Vocabulary

appliances, battery, brighter, bulb, buzzer, cell, components, conductor, device, electricity, insulator, lamp, loop, metals, motor, parts, series circuit, switch, wire

Key Scientists

Hertha Ayrton *(Engineer, Physicist & Inventor)*

Joseph Swan *(Physicist, Chemist & Inventor)*

Prior Learning

Children will have an awareness that:

- Objects need electricity to work.
- That a switch will turn something on or off.
- Some electric hazard awareness.

N.B. This is a new unit of learning not studied previously.

Future Learning

In Year 6 children will:

- Associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit.
- Compare and give reasons for variations in how components function, including the brightness of bulbs, the loudness of buzzers and the on/off position of switches.
- Use recognised symbols when representing a simple circuit in a diagram.

Key Questions

- What would life be like without electricity?
- What sorts of things use/need electricity?
- In which ways can we 'get' electricity? (mains/plugs/batteries/wireless)
- How do we make electricity?
- How do batteries work?
- How quickly can batteries run out? Does this make a difference depending on the number of components?
- How does the number of batteries added to the circuit affect a device?
- What materials can carry electricity? (conductors/insulators)

How does the thickness of a conducting material affect how bright the lamp is?
Which metal is the best conductor of electricity?

How would you group these electrical devices based on where the electricity comes from?

How long does a battery light a torch for?

Which room has the most electrical sockets in a house? Why?

How has electricity changed the way we live?

How does a light bulb work?

BIG Question
(assessment opportunity)

What can we do with electricity?

5 types of enquiry symbols from: https://seerih-innovations.org/enquiringscience4all/

Living things and their habitats - Year 5

National Curriculum Objectives

- Describe the differences in the life cycles of a mammal, an amphibian, an insect and a bird.
- Describe the life process of reproduction in some plants and animals.

Sticky Knowledge

- Different animals mature at different rates and live to different ages.
- Some organisms reproduce sexually where offspring inherit information from both parents.
- Some organisms reproduce asexually by making a copy of a single parent.
- Environmental change can affect how well an organism is suited to its environment.
- Different types of organisms have different life cycles.

Vocabulary

amphibians, animals, asexual, birds, bulb, changes, cuttings, differences, dispersal, fertilisation, gestation, habitats, insects, life cycle, life process, mammals, parent plant, plants, pollination, reproduction, root, seed, sexual, similarities, stem, tuber

Key Scientists

Mary Agnes Chase *(Botanist)*

David Attenborough *(Broadcaster & Natural Historian)*

Prior Learning

In Year 4 children should:

- Recognise that living things can be grouped in a variety of ways.
- Explore and use classification keys to help group, identify and name a variety of living things in their local and wider environment.
- Recognise that environments can change and that this can sometimes pose dangers to living things.

Future Learning

In Year 6 children will:

- Describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including microorganisms, plants and animals.
- Give reasons for classifying plants and animals based on specific characteristics.

Key Questions

- Do all animal embryos look the same?
- Are all life cycles the same?
- Are there any patterns between vertebrate animals and their gestation periods?
- Do plants reproduce in the same ways as humans?
- How do plants spread their seeds?

Which seed shape takes the longest time to fall?

Can you create a classification key for a group of plants?

How does a flower bud change as it opens?

How does an animal change over time (e.g. hatching chicks)?

Is there a relationship between a mammal's size and its gestation period?

What are the differences in the life cycles of an insect and a mammal?

BIG Question
(assessment opportunity)

Do all plants and animals reproduce in the same way?

5 types of enquiry symbols from: https://seerih-innovations.org/enquiringscience4all/

Animals, Including Humans - Year 5

National Curriculum Objectives

- Describe the changes as humans develop to old age.

Sticky Knowledge

- Puberty is something we all go through, a process which prepares our bodies for being adults, and reproduction.
- Hormones control these changes; which can be physical and/or emotional.
- Humans reproduce sexually where offspring inherit information from both parents.
- The average length of gestation in humans is 280 days, or 40 weeks.

Vocabulary

adolescent, adult, animals, baby, changes, develop, embryo, foetus, gestation, growth, hormones, humans, old age, puberty, teenager, timeline, toddler

Key Scientists

Elizabeth Blackwell *(Doctor)*

Patrick Steptoe, Robert Edwards & Jean Purdy *(Obstetrician, Physiologist & Embryologist)*

Prior Learning

In LKS2 children should:

- Identify that animals, including humans, need the right types and amount of nutrition, and that they cannot make their own food; they get nutrition from what they eat.
- Identify that humans and some other animals have skeletons and muscles for support, protection and movement.
- Describe the simple functions of the basic parts of the digestive system in humans.
- Identify the different types of teeth in humans and their simple functions.

Future Learning

In Year 6 children will:

- Identify and name the main parts of the human circulatory system, and describe the functions of the heart, blood vessels and blood.
- Recognise the impact of diet, exercise, drugs and lifestyle on the way their bodies function.
- Describe the ways in which nutrients and water are transported within animals, including humans.

Key Questions

- What do humans look like at each stage?
- How and why do humans change?
- What causes puberty?
- What changes do we go through during puberty?
- How do the gestation periods of other animals compare to humans?

How does age affect a human's reaction time?

Who grows the fastest, girls or boys?

Can you identify all the stages in the human life cycle and put it on a timeline?

How does the mass of a baby change over time?

Is there a relationship between a mammal's size and its gestation period?

What are the longest and shortest gestation periods in mammals?

Why do people get grey/white hair when they get older?

BIG Question
(assessment opportunity)

How do humans change across their lifetime?

5 types of enquiry symbols from: https://seerih-innovations.org/enquiringscience4all/

Properties and changes of materials - Year 5

National Curriculum Objectives

- Compare and group together everyday materials on the basis of their properties, including their hardness, solubility, transparency, conductivity (electrical and thermal), and response to magnets.
- Know that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution.
- Use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating.
- Give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic.
- Demonstrate that dissolving, mixing and changes of state are reversible changes.
- Explain that some changes result in the formation of new materials, and that this kind of change is not usually reversible, including changes associated with burning and the action of acid on bicarbonate of soda.

Sticky Knowledge

- All matter (including gas) has mass.
- Sometimes mixed substances react to make a new substance. These changes are usually irreversible.
- Heating can sometimes cause materials to change permanently. When this happens, a new substance is made. These changes are not reversible.
- Indicators that something new has been made are: The properties of the material are different (colour, state, texture, hardness, smell, temperature).
- Reversible changes can be reversed by: sieving, filtering, evaporating.

Vocabulary

acid, bicarbonate of soda, burning, chemical changes, chemists, dissolve, electrical conductivity, evaporate, everyday materials, filter, formation, gas, hardness, irreversible, liquid, magnets, melt, metal, mixtures, new materials, plastic, properties, reactions, reversible changes, rusting, separate, sieve, solid, solubility, solution, suspension, thermal conductivity, transparency, wood

Key Scientists

Spencer Silver & Arthur Fry
(Chemist & Inventor)

Stephanie Kwolek
(Chemist)

Prior Learning

In Year 4 children should:

- Compare and group materials together, according to whether they are solids, liquids or gases.
- Observe that some materials change state when heated or cooled, and measure and research the temperature at which this happens in degrees Celsius.
- Identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature.

Future Learning

In KS3 children will:

- The concept of a pure substance.
- Mixtures, including dissolving.
- Diffusion in terms of the particle model.
- Simple techniques for separating mixtures: filtration, evaporation, distillation and chromatography.
- The identification of pure substances.

Key Questions

- How would we know if we have made a new material or the same material just mixed differently?
- Add baking powder to vinegar, it fizzes up. Has a new substance been made? (Yes the gas was not in the vinegar as it wasn't fizzy, so it must have been made).
- Use lemon juice as an invisible ink, heating gently makes the ink visible. Is this a new substance?
- When water is added to jelly and it is set, is it a new substance?

Which material rusts fastest/slowest?

How can we change how wobbly jelly is?

Can you identify and classify these reactions and changes into reversible and irreversible? Can you describe their group's similarities and differences?

How does a nail in salt water change over time?

What patterns can you notice in different reactions?
How does the amount of bicarbonate of soda, washing up liquid and vinegar affect the reaction?

What are smart materials and how can they help us?

BIG Question
(assessment opportunity)

How can we change materials?

5 types of enquiry symbols from: https://seerih-innovations.org/enquiringscience4all/

Earth and Space - Year 5

National Curriculum Objectives

- Describe the movement of the Earth, and other planets, relative to the Sun in the solar system.
- Describe the movement of the Moon relative to the Earth.
- Describe the Sun, Earth and Moon as approximately spherical bodies.
- Use the idea of the Earth's rotation to explain day and night and the apparent movement of the sun across the sky.

Sticky Knowledge

- Stars, planets and moons have so much mass they attract other things, including each other due to a force called gravity. Gravity works over distance.
- Objects with larger masses exert bigger gravitational forces.
- Objects like planets, moons and stars spin.
- Smaller mass objects like planets orbit large mass objects like stars.
- Stars produce vast amounts of heat and light.
- All other objects are lumps of rock, metal or ice and can be seen because they reflect the light of stars.

Vocabulary

astronomical clock, axis, celestial body, day, Earth, geocentric, heliocentric, Jupiter, Mars, Mercury, Moon, movement, Neptune, night, orbit, phases, planets, rotation, Saturn, shadow clock, solar system, spherical, star, Sun, sundial, Uranus, Venus

Key Scientists

Galileo Galilei *(Astronomer, Physicist & Engineer)*

Mae Jemison *(Astronaut)*

Prior Learning

In KS1 and Year 3 children should:

- Understand changes in weather patterns and seasons.
- Compare how things move on different surfaces.
- Notice that some forces need contact between two objects, but magnetic forces can act at a distance.
- Describe magnets as having two poles.
- Predict whether two magnets will attract or repel each other, depending on which poles are facing.

Future Learning

In KS3 children will:

- Gravity force, weight = mass x gravitational field strength (g), on Earth g=10 N/kg, different on other planets and stars; gravity forces between Earth and Moon, and between Earth and Sun (qualitative only).
- Our Sun as a star, other stars in our galaxy, other galaxies.
- The seasons and the Earth's tilt, day length at different times of year, in different hemispheres.
- The light year as a unit of astronomical distance.

Key Questions

- How does temperature/size/day length/year length change as you get closer/further to the Sun?
- How does speed/size of a meteorite affect the size of the Moon crater formed?
- If the Moon became heavier as a result of meteorite collisions what would happen to its position relative to Earth?
- Why do we have day/night/months/years/seasons?
- Why does day length change?
- Why does shadow size change over the course of a day?

How does the number of daylight hours change in each season?

How could you organise all the objects in the solar system into groups?

Can you observe and identify all the phases in the cycle of the Moon?

Is there a pattern between the size of a planet and the time it takes to travel around the Sun?

How have our ideas about the solar system changed over time?

BIG Question
(assessment opportunity)

Sun, Earth & Moon: What is moving and how do we know?

5 types of enquiry symbols from: https://seerih-innovations.org/enquiringscience4all/

Forces - Year 5

National Curriculum Objectives

- Explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object.
- Identify the effects of air resistance, water resistance and friction, which act between moving surfaces.
- Recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect.

Sticky Knowledge

- Air resistance and water resistance are forces against motion caused by objects having to move air and water out of their way.
- Friction is a force against motion caused by two surfaces rubbing against each other.
- Some objects require large forces to make them move; gears, pulley and levers can reduce the force needed to make things move.
- Some objects/animals are streamlined to minimise the effects of air/water resistance.

Vocabulary

air resistance, Earth, fall, faster, force, friction, gear, gravity, greater, level, machines, mechanism, movement, object, opposing, parachute, pulley, slow down, smaller, stop, surface, theory of gravitation, unsupported, water resistance

Key Scientists

Albert Einstein
(Theoretical Physicist)

Archimedes
(Mathematician, Engineer & Inventor)

Prior Learning

In Year 3 children should:

- Compare how things move on different surfaces.
- Notice that some forces need contact between two objects, but magnetic forces can act at a distance.
- Observe how magnets attract and repel each other and attract some materials and not others.
- Compare and group together a variety of everyday materials on the basis of whether they are attracted to a magnet, and identify some magnetic materials.
- Describe magnets as having two poles.
- Predict whether two magnets will attract or repel each other, depending on which poles are facing.

Future Learning

In KS3 children will:

- Know about opposing forces and equilibrium: weight held by stretched spring or supported on a compressed surface.
- Recognise that forces are needed to cause objects to stop or start moving, or to change their speed or direction of motion (qualitative only) .
- Know that forces change depending on the direction of force and its size.
- Understand pressure in liquids including upthrust effects, floating and sinking.

Key Questions

- What actually is a force?
- How can a force act on an object?
- How can we see/measure forces?
- How does the saltiness (salinity) of water affect the water resistance?
- How does changing the shape of a piece of plasticine affect water resistance?
- How does adding holes to a parachute affect the time it takes to fall?
- How does the amount/depth of tread affect the friction between a shoe and a surface?
- How can we use levers to lift more?
- What is the most effective way to move an object?
- How do see-saws work?
- Can you create a pulley system to lift a given load?

How does the angle of launch affect how far a paper rocket will go?

How does the surface area of an object affect the time it takes to sink?

Can you label and name all the forces acting on the objects in each of these situations?

How long does a pendulum swing for before it stops?

Do all objects fall through water in the same way?
How does the surface area of a parachute affect the time it takes to fall?

How do submarines sink if they are full of air?

BIG Question
(assessment opportunity)

How and why do objects move?

5 types of enquiry symbols from: https://seerih-innovations.org/enquiringscience4all/

Living things and their habitats - Year 6

National Curriculum Objectives

- Describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including microorganisms, plants and animals.
- Give reasons for classifying plants and animals based on specific characteristics.

Sticky Knowledge

- Variation exists within a population (and between offspring of some plants) – *NB: this Key Idea is duplicated in Year 6 Evolution and Inheritance.*
- Organisms best suited to their environment are more likely to survive long enough to reproduce.
- Organisms reproduce and offspring have similar characteristic patterns.
- Competition exists for resources and mates.
- Scientists, called Taxonomists, sort and group living things according to their similarities and differences.

Vocabulary

amphibians, animals, bacteria, birds, characteristics, classification system, classified, differences, fish, groups, habitats, insects, invertebrates, key, living things, mammals, micro-organisms, organisms, plants, reptiles, similarities, snails, spiders, subdivided, variation, vertebrates, worms

Key Scientists

Carl Linnaeus
(Botanist & Zoologist)

Marjory Stoneman Douglas
(Writer & Conservationist)

Prior Learning

In Year 4 children should:

- Recognise that living things can be grouped in a variety of ways.
- Explore and use classification keys to help group, identify and name a variety of living things in their local and wider environment.
- Recognise that environments can change and that this can sometimes pose danger to living things.

Future Learning

In KS3 children will learn:

- The dependence of almost all life on Earth on the ability of photosynthetic organisms, such as plants and algae, to use sunlight in photosynthesis to build organic molecules and to maintain levels of oxygen and carbon dioxide in the atmosphere.
- The adaptations of leaves for photosynthesis.
- The interdependence of organisms in an ecosystem, including food webs and insect pollinated crops.
- The importance of plant reproduction through insect pollination in human food security.
- How organisms affect, and are affected by, their environment, including the accumulation of toxic materials.

Key Questions

- Why do we need to classify living things?
- How do we classify?
- What are the difficulties with classification? (penguins, whales, platypus)
- How do animals change over time?
- Why does variation exist?
- What happens if animals of different species breed? (hybrids)
- What happens to house plants outside?
- What are microorganisms?
- How can we prevent the spread of disease?
- Why do animals and plants compete – and what for?

How does the temperature affect how much gas is produced by yeast?

How would you make a classification key for vertebrates/ invertebrates or microorganisms?

Do all fruits grow mould in the same way over time?

Are all exoskeletons the same?

What do different types of microorganisms do? Are they always harmful?

BIG Question
(assessment opportunity)

In what ways can we sort living things?

5 types of enquiry symbols from: https://seerih-innovations.org/enquiringscience4all/

Animals, including humans - Year 6

National Curriculum Objectives

- Identify and name the main parts of the human circulatory system, and describe the functions of the heart, blood vessels and blood.
- Recognise the impact of diet, exercise, drugs and lifestyle on the way their bodies function.
- Describe the ways in which nutrients and water are transported within animals, including humans.

Sticky Knowledge

- The heart pumps blood around the body.
- Oxygen is breathed into the lungs where it is absorbed by the blood.
- Muscles need oxygen to release energy from food to do work. (Oxygen is taken into the blood in the lungs; the heart pumps the blood through blood vessels to the muscles; the muscles take oxygen and nutrients from the blood.)
- Drugs, alcohol and smoking have negative effects on the body.

Vocabulary

animals, artery, blood, blood vessels, circulatory system, damaged, deoxygenated, diet, digestive system, drugs, exercise, functions, harm, health, heart, human, impact, internal organs, lifestyle, muscular system, nutrients, oxygenated, respiration, skeletal system, substances, transported, valve, veins, water

Key Scientists

Marie Curie
(Physicist & Chemist)

Alexander Fleming
(Physician & Microbiologist)

Prior Learning

In Year 5 children should:

- Describe the changes as humans develop to old age.

In Year 4 children should:

- Describe the simple functions of the basic parts of the digestive system in humans.
- Identify the different types of teeth in humans and their simple functions.
- Construct and interpret a variety of food chains, identifying producers, predators and prey.

Future Learning

In KS3 children will learn:

- The hierarchical organisation of multicellular organisms: from cells to tissues to organs to systems to organisms.
- The tissues and organs of the human digestive system, including adaptations to function and how the digestive system digests food (enzymes).
- Calculations of energy requirements in a healthy daily diet.
- The consequences of imbalances in the diet, including obesity, starvation and deficiency diseases.
- The structure and functions of the gas exchange system in humans, including adaptations to function.
- The effects of recreational drugs (including substance misuse) on behaviour, health and life processes.

Key Questions

- Why do we need oxygen?
- How do we breathe?
- Do fish and plants breathe?
- Do all living things need oxygen?
- How does the size of a person's lungs affect their lung capacity?
- Are there ways to increase/decrease our lung capacity? Is lung capacity fixed?
- Why do we have blood?
- How does our heart work?
- How does exercise affect our pulse rate?
- How might the circulatory system of an elephant, a hummingbird, or a polar bear differ?
- Is the air you breathe out, the same as that you breathe in?

How does the length of time we exercise for affect our heart rate?
Which type of exercise has the greatest effect on our heart rate?

Which organs of the body make up the circulation system, and where are they found?

How does my heart rate change over the day?

How much exercise do I do in a week?

Is there a pattern between what we eat for breakfast and how fast we can run?

How have our ideas about disease and medicine changed over time?

BIG Question
(assessment opportunity)

How do our choices affect how our bodies work?

Why does my heart beat?

5 types of enquiry symbols from: https://seerih-innovations.org/enquiringscience4all/

Evolution and inheritance - Year 6

National Curriculum Objectives

- Recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago.
- Recognise that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents.
- Identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution.

Sticky Knowledge

- Life cycles have evolved to help organisms survive to adulthood.
- Over time the characteristics that are most suited to the environment become increasingly common.

NB: The following could be duplicated in Year 6 Living things and their habitats.

- Organisms best suited to their environment are more likely to survive long enough to reproduce. Organisms best adapted to reproduce are more likely to do so.
- Organisms reproduce and offspring have similar characteristic patterns.
- Variation exists within a population (and between offspring of some plants).
- Competition exists for resources and mates.

Vocabulary

adapted, adaption, breed, changed, characteristics, competitions, environment, evolution, fossils, identical, inhabited, inherited, living things, mutation, offspring, parents, produce, reproduction, suit, survive, survival of the fittest, variation, vary

Key Scientists

Charles Darwin
(Naturalist)

Gregor Mendel
(Botanist & Biologist)

Prior Learning

In KS1 and KS2 children should:

- Understand there is a variety of life on Earth.
- Know that some animals' differences are important to their survival.
- Know how animals and plants reproduce.
- Know how fossils form over time.

NB: This unit builds on understanding from a variety of year groups and units of learning.

Future Learning

In KS3 children will learn:

- Heredity as the process by which genetic information is transmitted from one generation to the next.
- The variation between individuals within a species being continuous or discontinuous, to include measurement and graphical representation.
- The variation between species and between individuals of the same species means some organisms compete more successfully, which can drive natural selection.
- Changes in the environment may leave individuals, and some entire species, less well adapted to compete and reproduce, which may lead to extinction.
- The importance of maintaining biodiversity and the use of gene banks to preserve hereditary material.

Key Questions

- Why are we all different?
- What is variation, and why is it important?
- How did life begin on Earth?
- How do we change?
- What is evolution?
- What evidence is there for evolution?
- How does evolution happen?
- What reasons do animals become extinct?
- The habitat for [animal name] is rapidly changing, what possible futures do they face and can we predict which is most likely?
- How did Darwin come up with the theory?
- Why was his theory not initially accepted?

What is the most common eye colour in our class?

Can you identify the characteristics you have inherited from your parents? (or use the Molliebird story).

How has the skeleton of the horse changed over time?

Is there a pattern between the size and shape of a bird's beak and the food it will eat?

What happened when Charles Darwin visited the Galapagos islands?

BIG Question
(assessment opportunity)

What is evolution, how does it happen and how do scientists know?

5 types of enquiry symbols from: https://seerih-innovations.org/enquiringscience4all/

Light - Year 6

National Curriculum Objectives

- Recognise that light appears to travel in straight lines.
- Use the idea that light travels in straight lines to explain that objects are seen because they give out or reflect light into the eye.
- Explain that we see things because light travels from light sources to our eyes or from light sources to objects and then to our eyes.
- Use the idea that light travels in straight lines to explain why shadows have the same shape as the objects that cast them.

Sticky Knowledge

- Animals see light sources when light travels from the source into their eyes.
- Animals see objects when light is reflected off that object and enters their eyes.
- Light reflects off all objects (unless they are black). Non shiny surfaces scatter the light so we don't see the beam.
- Light travels in straight lines, called rays or beams of light.

Vocabulary

beam, cast, coloured filters, emitted , eye, glare, light, light source, periscope, rainbows, reflect, reflection, shadows, straight lines, Sun, travel, visible

Key Scientists

Thomas Edison
(Inventor)

Edith Clarke
(Electrical Engineer)

Prior Learning

In Year 3 children should:

- Recognise that they need light in order to see things and that dark is the absence of light.
- Notice that light is reflected from surfaces.
- Recognise that light from the sun can be dangerous and that there are ways to protect their eyes.
- Recognise that shadows are formed when the light from a light source is blocked by a solid object.
- Find patterns in the way that the sizes of shadows change.

Future Learning

In KS3 children will learn:

- The similarities and differences between light waves and waves in matter.
- Light waves travelling through a vacuum; speed of light.
- The transmission of light through materials: absorption, diffuse scattering and specular reflection at a surface.
- Use of a ray model to explain imaging in mirrors, the pinhole camera, the refraction of light and action of convex lens in focusing (qualitative); the human eye.
- Light transferring energy from source to absorber leading to chemical and electrical effects; photo-sensitive material in the retina and in cameras.
- Colours and the different frequencies of light, white light and prisms (qualitative only); differential colour effects in absorption and diffuse reflection.

Key Questions

- How does the size of an object affect the size of a shadow?
- How does the distance between the light and the object change the size of a shadow?
- How does the distance between the object and the size of the screen affect the size of a shadow?
- How does the amount of aluminium foil scrunched affect how much light is scattered?
- How does the amount of polishing affect how well a piece of metal scatters light?
- How perfect are our mirrors? Do some scatter light more than others?
- What happens to light when it is shone through water? How is this affected by putting glitter, salt or talc in the water?
- How does a periscope/microscope/telescope work?

How does the angle that a light ray hits a plane mirror affect the angle at which it reflects off the surface?
Which material is most reflective?

Can you identify all the colours of light that make white light when mixed together?
What colours do you get if you mix different colours of light together?

How do my pupils change throughout the day?

Is there a pattern to how bright it is in school over the day? If there is a pattern, is it the same in every classroom?

Why do some people need to wear glasses to see clearly?

How do our eyes adapt to different conditions?

BIG Question
(assessment opportunity)

How can we keep ourselves visible when walking/cycling in the dark?

5 types of enquiry symbols from: https://seerih-innovations.org/enquiringscience4all/

Electricity - Year 6

National Curriculum Objectives

- Associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit.
- Compare and give reasons for variations in how components function, including the brightness of bulbs, the loudness of buzzers and the on/off position of switches.
- Use recognised symbols when representing a simple circuit in a diagram.

Sticky Knowledge

- Batteries are a store of energy. This energy pushes electricity around the circuit.
- When the battery's energy is gone it stops pushing. Voltage measures the 'push.'
- Symbols for: lamp, wire, buzzer, cell, battery, motor, switch (open), switch (closed).
- A series circuit will not work if a lamp is broken or a wire is disconnected.

Vocabulary

brightness, bulb, buzzer, cells, circuits, components, diagram, function, insulator, lamp, loudness, motor, series circuit, switches, symbols, variations, voltage, volume

Key Scientists

Michael Faraday *(Physicist & Chemist)*

William Kamkwamba *(Inventor)*

Prior Learning

In Year 4 children should:

- Identify common appliances that run on electricity.
- Construct a simple series electrical circuit, identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzers.
- Identify whether or not a lamp will light in a simple series circuit, based on whether or not the lamp is part of a complete loop with a battery.
- Recognise that a switch opens and closes the circuit and associate this with whether or not a lamp lights in a simple series circuit. Recognise some common conductors and insulators, and associate metals with being good conductors.
- Recognise some common conductors and insulators, and associate metals with being good conductors.

Future Learning

In KS3 children will learn:

- Electric current: measured in amperes, in circuits (series and parallel), currents add where branches meet and current as flow of charge.
- Potential difference, measured in volts, battery and bulb ratings; resistance, measured in ohms, as the ratio of potential difference (p.d.) to current.
- Differences in resistance between conducting and insulating components (quantitative).
- Separation of positive or negative charges when objects are rubbed together: transfer of electrons, forces between charged objects.
- The idea of electric field forces acting across the space between objects not in contact.

Key Questions

- Do all batteries push as hard as each other?
- How does the voltage of a battery affect how much current is pushed?
- How does the number of bulbs affect the brightness of a bulb?
- Are all types of wires as good at conducting electricity?
- Why are wires insulated in plastic? Does the type of material make a difference?
- Does the length of wire make a difference?
- Does the type of circuit affect how the components work/long the battery lasts?
- What renewable ways can we generate electricity?
- What are the dangers of a short circuit?

Which make of battery lasts the longest?

Which type of fruit makes the best fruit battery?

How would you group electrical components and appliances based on what electricity makes them do?

How does the brightness of the bulb change as the battery runs out?
How can we measure how quickly a battery is used up?

Does the temperature of a light bulb change the longer it is on?

How has our understanding of electricity changed over time?

BIG Question
(assessment opportunity)

Can we vary the effects of electricity?

5 types of enquiry symbols from: https://seerih-innovations.org/enquiringscience4all